ISSN : 0974 - 7435 Volume 10 Issue 11

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(11), 2014 [5021-5029]

Analytic hierarchy process-based elementary and secondary schools' martial arts teaching reformation practice route study

Kuangheng Wu, Jinjin Zhao*

The Military Physical Education Department, Jilin Agricultural University, Changchun 130118, Jilin, (CHINA)

ABSTRACT

Physical education and traditional culture combination becomes more and more frequently, martial arts as Chinese historical sports representative, is an important content of elementary and secondary schools' sports courses. However, due to multiple factors impacts, elementary and secondary martial arts physical education course development status are criticized, their teaching reformation is of widely concerns. The paper utilizes analytic hierarchy process, targeted at martial arts contents' freehand routine, devices routines, sanda, power law four kinds of sports, it makes research from the degree of attention of the school, students' martial arts understanding status, level of teaching of martial arts teachers, students satisfaction degree, teaching space the five perspectives. Research result shows sanda is best sports event in martial arts teaching, therefore in future reformation process, it should take sanda as main reformation orientation, and further define teaching reformation practice route.

KEYWORDS

Analytic hierarchy process; Martial arts teaching reformation; Teaching level; Judgment matrix.

INTRODUCTION

Martial arts is a representative word of Chinese characteristics, it has a long history, is broad and profound. Martial arts have features of self-cultivation, building one's body, presently elementary and secondary schools' martial arts education teaching status is not going well, students' interests, teachers' teaching ability and other problems affect martial arts development. Therefore, elementary and secondary school martial arts teaching reformation is imperative.

In 2012, Su Wen-Dian in the article "Jiangxi province elementary and secondary schools' regional traditional martial arts organization research –take zimenquan as an example", took Jiangsu regional traditional martial arts as research objects, comprehensive used multiple research methods, targeted at Jiangxi province four regions' old boxing teachers, martial arts coaches, practitioners and local students and teachers, he made investigation and analysis. Investigation result shows by far Jiangxi province traditional martial arts development was not satisfactory. Regional martial arts own factors, social factors and cultural factors common restricted martial arts development. The article pointed out that schools' martial arts physical education course education had multiple problems, from which it contained weak social publicity, schools' ignorance, teachers' resources shortage, physical course land shortage, little martial arts class hours. The author supposed to let regional traditional martial arts to be introduced into elementary and secondary physical education courses, and meanwhile, each circle media and education department provided relevant supports so that let regional traditional martial arts to be well developed. In 2011, Zhao Jian-Ping in article "Elementary and secondary schools martial arts exercises compilation and teaching practice research", comprehensive used multiple research methods to study martial arts compilation and teaching, studied from compiling martial arts teaching interests, movement difficulties, martial arts culture, attack and defense features as others multiple perspectives, research result shows that elementary and secondary schools martial arts exercises innovation should base on fitness and cultural features, highlight national cultural characteristics. And meanwhile it should focus on unification of body building and cultural inheritance, targeted and connection, simplicity and artistry, epochal character and national character. The paper pointed out that compiled martial arts movement should be easily carried forward and popularized. In 2008, Wang Jia-Zhong in the article " Jin and Chu Martial arts cultural research", took Jin and Chu martial arts culture as research objects, pointed out Jin and Chu martial arts had health care character, interests and fashionability as well as other features. It not only had higher promotion values in schools, but also can propel to local tourism to great extent, and drive local economy. The article pointed out that Jin and Chu culture boxing types are various, and meanwhile it had innovation that advanced with the times, was fit for spreading.

The paper aims to research elementary and secondary schools' martial arts teaching reformation practice route, considers martial arts teaching influence factors from multiple perspectives, and then looks for best path of elementary and secondary martial arts teaching reformation practice.

AHP MODEL ESTABLISHMENT

AHP can solve relative tedious and vague problems' decision-making problems. Use the method to construct model, it roughly needs four steps :

Establish hierarchical structure scheme;

Construct every layer that fully used in judgment matrix;

Hierarchical single arrangement and consistency test;

Hierarchical total arrangement and consistency test;

In the following, it respectively states each step detailed process.

Hierarchical structure

AHP solved problems are required to be hierarchic, orderly and logic. Only then it can construct hierarchical scheme. Let tedious problems' elements to form into multiple hierarchies according to its attributes, membership and its relations. Last hierarchical element plays a dominate role in next hierarchical relative elements. In general, these hierarchies can be divided into 3 types:

(1) Top layer: Only one element in this hierarchy, it normally is final target of analytic problems. The layer is also called target hierarchy.

(2) Middle hierarchy: In this hierarchy, it includes intermediate links that get involved to fulfill targets, which can be composed of some hierarchies that include multiple and multilayer criterions that required to consider. It can also be called criterion hierarchy.

(3) The bottom hierarchy: This hierarchy includes optional each method and way to fulfill targets. It can also be called measure hierarchy or scheme hierarchy.

Hierarchy numbers in hierarchical structure have something to do with problem's complicated degree as well as analysis detailed requirements, normally the hierarchy numbers are not limited, each element in every hierarchy governs less than 9 elements. Hierarchical structure is as Figure 1.

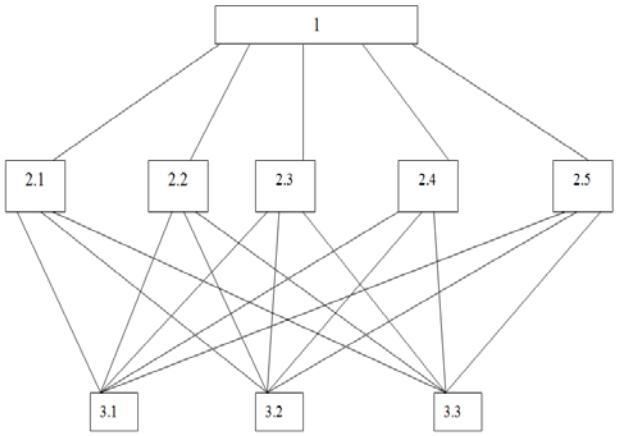

Figure 1 : Hierarchical structure chart

In Figure 1, layer 1 is target layer that is the purpose which is required to finally fulfill for researching problems, layer 2 is criterion layer that is the medium process that researching problems go through, layer 3 is scheme layer that is each kind of referencing schemes.

Judgment matrix construction

Each layer structure can show factors relationships, but in middle layer, each factor occupied proportion in target evaluation basically will not be fully the same, in the heart of evaluators, each factor has certain proportions.

When define each factor proportion that is to compare n pieces of factors $X = \{x_1, \cdots, x_n\}$ to factor Z impacts. *Saaty* and others proposed to carry out paired comparison among factors, and constructed comparison matrix method. That is to say, it selects two factors x_i and x_j every time, uses a_{ij} to express x_i and x_j to Z impacts ratios, all comparison is using matrix $A = (a_{ij})_{n\times n}$ to express, A has become judgment matrix between $Z - X$. From matrix, it is clear that if x_i and x_j to Z impact ratio is a_{ij} , then x_j and x_i to Z impact ratio is $a_{ji} = \frac{1}{a_{ij}}$.

According to linear algebra theoretical knowledge, if matrix $A=(a_{ij})_{n\times n}$ meets $a_{ij}>0$ and $a_{ji}=\frac{1}{a_{ij}}(i,j=1,2,\cdots,n)$, then matrix A is positive reciprocal matrix.

a_{ij} Value determination can accord scale table, contents are as following TABLE 1.

TABLE 1 : scale table

Scale	Definition
1	Indicates two factors have equal importance by comparing
3	Indicates the former is slightly more important than the later by comparing two factors
5	Indicates the former is obviously more important than the later by comparing two factors
7	Indicates the former is intensely more important than the later by comparing two factors
9	Indicates the former is extremely more important than the later by comparing two factors
2, 4, 6, 8	Indicates middle level of above judgment
Reciprocal	If importance ratio between i and j is a_{ij}, then importance ratio between j and i is $a_{ji}=\frac{1}{a_{ij}}$.

Judgment matrix construction

Matrix A corresponding maximum feature value $\lambda_{\max}$ feature vector W, it is the priority weight of same hierarchy corresponding elements relative importance to last hierarchy some element through normalization, the process is called hierarchical single arrangement. Though the process can reduce other factors interference, it is hard to avoid appearing inconsistency to some extent when integrate all comparison results. If comparison results are consistent, then A factor should also meet:

$$a_{ij}a_{jk}=a_{ik},\forall i,j,k=1,2,\cdots,n \quad \textbf{(1)}$$

The positive reciprocal matrix that meets above formula is called consistent matrix. To easy define A can be accepted or not, it should test A inconsistency is very serious or not.

If A is consistent matrix, then

① A surely is positive reciprocal matrix.

② Transposed matrix A^T is consistent matrix.

③ A matrix any two lines are in proportions, and factors are above 0, therefore $rank(A)=1$, so is the column.

④In A, $\lambda_{\max}=n$, n is A matrix order number. Other features roots of A is 0.

⑤ $\lambda_{\max}$ corresponding feature vector $W=(w_1,\cdots,w_n)^T$, then $a_{ij}=\frac{w_i}{w_j},\forall i,j=1,2,\cdots,n$, so:

$$A=\begin{bmatrix} \frac{w_1}{w_1} & \frac{w_1}{w_2} & \cdots & \frac{w_1}{w_n} \\ \frac{w_2}{w_1} & \frac{w_2}{w_2} & \cdots & \frac{w_2}{w_n} \\ \vdots & \vdots & \vdots & \vdots \\ \frac{w_n}{w_1} & \frac{w_n}{w_2} & \cdots & \frac{w_n}{w_n} \end{bmatrix} \quad \textbf{(2)}$$

A is n order positive reciprocal matrix, when it is consistent matrix, when and only when $\lambda_{\max}=n$ as well as when A is inconsistent, it surely has $\lambda_{\max}>n$. Thereupon, use $\lambda_{\max}$ and n relationship to test whether A is consistent matrix or not.

A consistency test steps:

Calculate consistency indicator CI,

$$CI=\frac{\lambda_{\max}-n}{n-1} \quad \textbf{(3)}$$

Consult corresponding average random consistency indicator RI. *Saaty* researched RI value, RI value could refer to TABLE 2.

TABLE 2 : RI value

n	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45

RI Value is got in this way that randomly constructs 500 sample matrixes. Random select numbers from $1\sim 9$ as well as its reciprocals to construct positive reciprocal matrix, and determine average value of maximum feature root $\lambda'_{\max}$, and define:

$$RI=\frac{\lambda'_{\max}-n}{n-1} \quad \textbf{(4)}$$

Solve consistency ratio CR

$$CR=\frac{CI}{RI} \quad \textbf{(5)}$$

When $CR<0.10$, it is thought that A consistency is acceptable, otherwise it should make proper correction.

In the process, it also includes hierarchical total arrangement and consistency test, due to article lengths are limited, no theoretical statements here, directly apply it in the following.

MARTIAL ARTS EDUCATION REFORMATION BEST PATH MODEL ESTABLISHMENT

TABLE 3 data is from the article" Shijiazhuang city elementary and secondary martial arts teaching status and analysis".

TABLE 3 : Students' interests in martial arts contents (%)

Number of people	Freehand routine	Devices routine	Sanda	Power law	Others
30	25	20.6	42.6	10.3	1.5

From TABLE 3 data, we can know that elementary and secondary schools' martial arts teaching main contents are freehand routine, devices routine, sanda and power law four kinds of contents.

The paper aims to look for elementary and secondary schools martial arts education reformation best path, main factors that affect teaching quality contain the degree of attention of the school, students' martial arts understanding status, level of teaching of martial arts teachers, students' satisfaction degree, teaching space these five factors. Therefore, criterion layer should contain the five influence factors. The model needs to make comparison on freehand routine, devices routine, sanda, power law these four martial arts events, the scheme layer contains the four items. Hierarchical structure is as Figure 2.

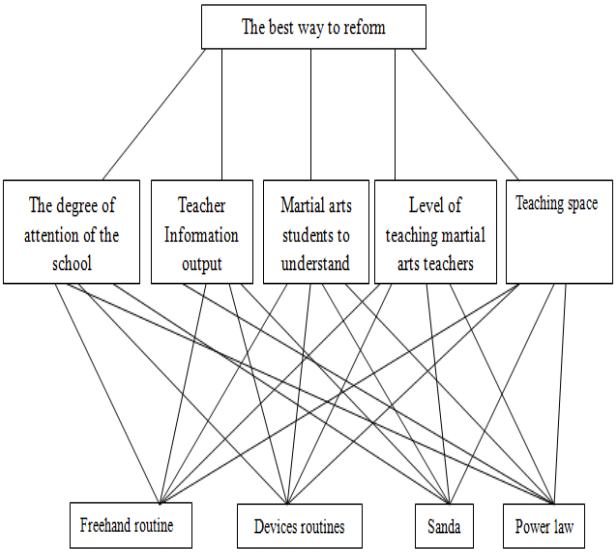

Figure 2 : Hierarchical structure chart

Judgment matrix construction

Judgment matrix construction firstly needs to define martial arts teaching quality influential five factors importance. Adopt random investigation method, randomly select 100 teachers, 100 students and 100 parents to make investigation, handle with investigation result; it gets result as TABLE 4.

TABLE 4: Five kinds of influence factors importance comparison

	Quantity	Percentage（%）	Rank
Emphasis	150	50	1
Understanding level	136	45.3	2
Teaching level	105	35	3
Satisfaction degree	74	24.7	4
Teaching space	39	13	5

Thereupon, we establish target layer paired comparison matrix, as TABLE 5 show.

TABLE 5 : Target layer paired comparison matrix

A	B_1	B_2	B_3	B_4	B_5
B_1	1	2	4	6	8
B_2	1/2	1	2	4	6
B_3	1/4	1/2	1	2	4
B_4	1/6	1/4	1/2	1	3
B_5	1/8	1/6	1/4	1/3	1

Then, establish criterion layer paired matrix, contents are as TABLE 6-10. By practical investigation, we find that the degree of attention of the school, students' martial arts understanding status, level of teaching of martial arts teachers, students' satisfaction degree the four indicators status are basically the same; therefore, TABLE 6-9 contents are basically the same.

TABLE 6 : Criterion layer paired matrix one

B_1	P_1	P_2	P_3	P_4
P_1	1	2	1/2	3
P_2	1/2	1	1/3	2
P_3	2	3	1	4
P_4	1/3	1/2	1/4	1

TABLE 7 : Criterion layer paired matrix two

B_2	P_1	P_2	P_3	P_4
P_1	1	2	1/2	3
P_2	1/2	1	1/3	2
P_3	2	3	1	4
P_4	1/3	1/2	1/4	1

TABLE 8 : Criterion layer paired matrix three

B_3	P_1	P_2	P_3	P_4
P_1	1	2	1/2	3
P_2	1/2	1	1/3	2
P_3	2	3	1	4
P_4	1/3	1/2	1/4	1

TABLE 9 : Criterion layer paired matrix four

B_4	P_1	P_2	P_3	P_4
P_1	1	2	1/2	3
P_2	1/2	1	1/3	2
P_3	2	3	1	4
P_4	1/3	1/2	1/4	1

TABLE 10 : Criterion layer paired matrix five

B_5	P_1	P_2	P_3	P_4
P_1	1	2	5	4
P_2	1/2	1	2	3
P_3	1/5	1/2	1	1/2
P_4	1/4	1/3	2	1

Computed result

In stated computation process, it can calculate by *Matlab* software program, computed result is as TABLE 11.

TABLE 11 : Hierarchical total arrangement

Criterion		**Emphasis**	**Understanding status**	**Teaching level**	**Satisfaction degree**	**Teaching space**	**Total arrangement weight**
Criterion weight		0.4690	0.2667	0.1413	0.0825	0.0406	
Scheme layer single arrangement	Scheme1	0.2772	0.2772	0.2772	0.2772	0.5186	0.287
	Scheme 2	0.1601	0.1601	0.1601	0.1601	0.3463	0.201
	Scheme 3	0.4673	0.4673	0.4673	0.4673	0.0941	0.462
	Scheme 4	0.0954	0.0954	0.0954	0.0954	0.0782	0.095

In order to intuitive express freehand routine, devices routine, sanda, power law four martial arts contents judgment status, as Figure 3.

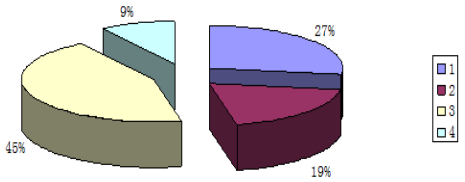

Figure 3 : The figure of evaluation results

From Figure 3, we can clearly see that Sanda is best reformation orientation, therefore in martial arts education reformation process, each education department should give sanda superiority into play and make clear reformation path.

CONCLUSIONS

Analytic hierarchy process flexibility is higher; application range is wide; therefore it is widely used in each field. But in analytic hierarchy process, it needs to judge paired factors importance ratio,

define comparison value according to experience, let same things judgment result to be different. When comparison value defining is incorrect, it may cause wrong results.

The paper applies analytic hierarchy process into martial arts teaching reformation practice paths comparison, the main purpose is to define reformation orientation so as to further define martial arts teaching reformation refining contents. By the paper established model's analysis, we find that sanda is an event that relative fit for pupils and middle school students in martial arts contents, therefore, make further innovation and reformation on its contents, amend its educational forms, which is a reasonable way of martial arts teaching reformation practical path.

ACKNOWLEDGMENT

The 12th five-year plan subject fund project: jilin province department of education.

Project name: Jilin province college student's physical exercise capacity decreased number: the i ntervention of the research, educational, scientific and cultural word [2011] no. 437.

REFERENCES

[1] Xu Bo, Xie Tie-Tu; A Study on the Landslide of China's Competitive Basketball Games and Countermeasures, Journal of Beijing Sport University, **5(5)**, 101-105 **(2010)**.

[2] Ia Dong-Chen; Countermeasure and Causation of Imbalance of Teams Athletic Competence in CBA, Journal of Hebei Institute of Physical Education, **23(1)**, **(2009)**.

[3] Huang Song-Feng; Research on the Countermeasures for Chinese Man's Basketball Team in London Olympics, China Sport Science and Technology, **47(1)**, **(2011)**.

[4] Chen Jun, Shi Yan; A Countermeasure Study about Realizing Sustainable Development of Basketball Professionalism in China, Journal of Beijing Sport University, **25(3)**, 301-302, 308, **(2002)**.

[5] Jia Ning, Sun Han Chao; Objectives of developing the Chinese competitive sports of the early 21st century and studies of the countermeasures, Journal of Wuhan Institute of Physical Education, **35(6)**, 1-4 **(2001)**.

[6] Wang Yun, Cheng Yao; Strength Pattern of Current World Man's Basketball from the View of 15th World Man's Basketball Championships, China Sport Science and Technology, **43(4)**, 77-81 **(2007)**.

[7] Xue Haitao; A Study of the Causes and Countermeasures of the Decline of Competitive Basketball in China, Bulletin of Sport Science & Technology, **21(2)**, 26-27 **(2013)**.

[8] Ma Jinrong, Gong Shijun; Some Problems of Wcba League Teams and Foreign Main Centre, Journal of Shenyang Sport University, **31(3)**, 84-88 **(2012)**.